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Other

Curve & Surface

Meshing Algorithms

CUBIT Users Workshop

FeatureSize Curve Meshing

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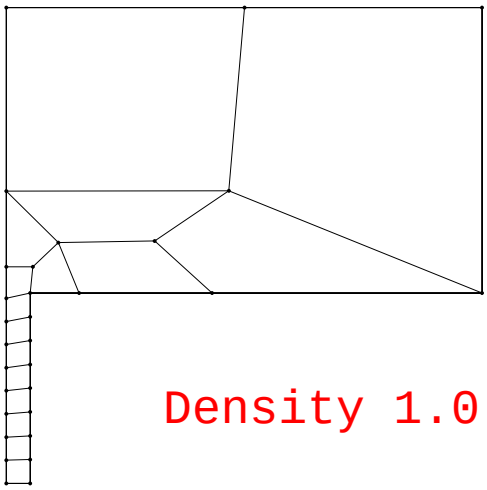
Recall `Equal` and `Bias` meshing schemes

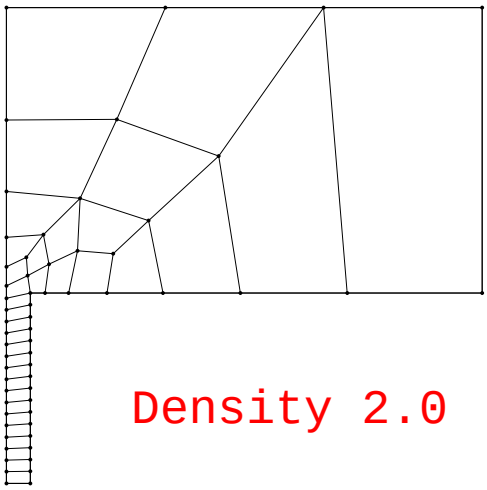
```
Curve <curve_id_range> Scheme FeatureSize
```

length of edge = to distance to geometry

```
Curve <curve_id_range> Density <factor>
```



Density 1.0



Density 2.0

Example file: featuresize.jou

Sizing Function based Paving

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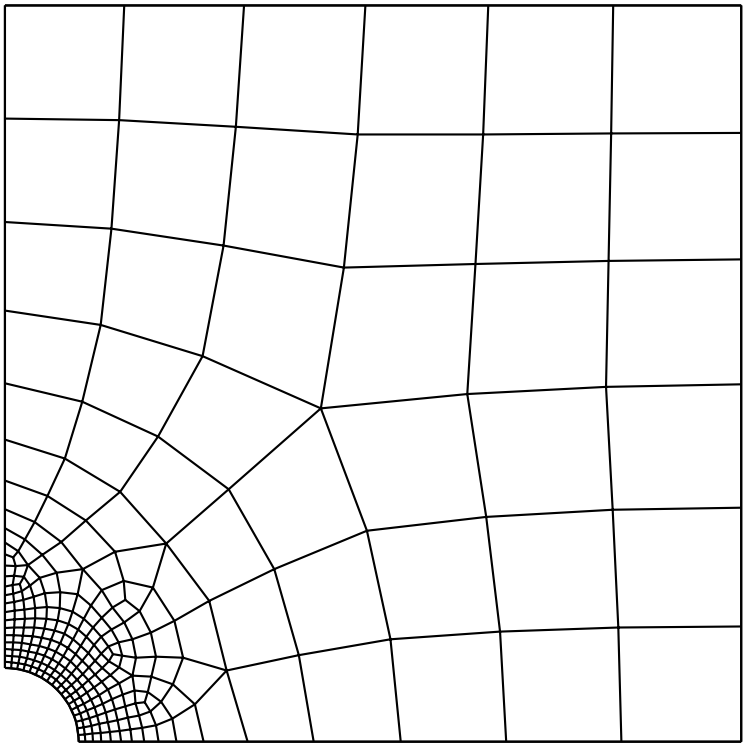
Import a general sizing function.

Determines element size for Paving (only)

- Contact CUBIT team (e.g. Randy Lober) for details.



Example file: adaptivity.jou

Surface Meshing Schemes

`entity <id_range> scheme auto`

Automatically select surface scheme

- new capability, in development
- conservative, overselects paving v.s. “try map & fail”
- try it, then change schemes manually if problems!

Example file: auto-select.jou

Triangle Surface Meshing

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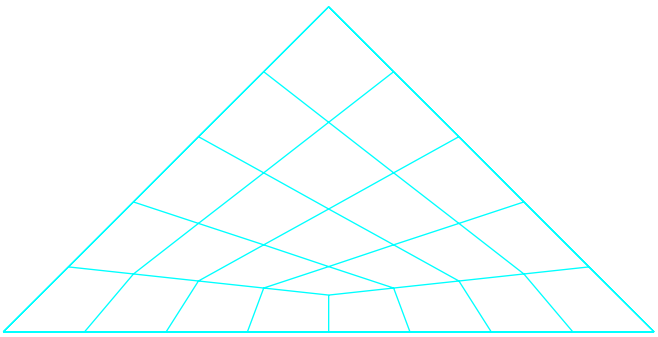
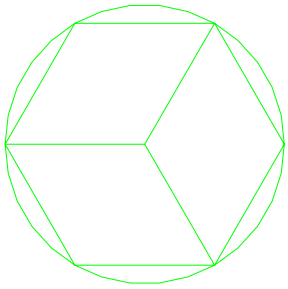
`Surface <id_range> Scheme Triangle`

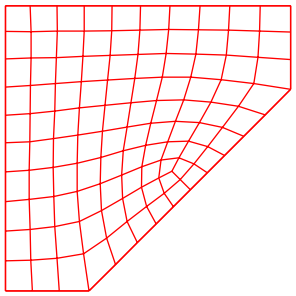
Triangle-primitive, like rectangle map



- Don’t need exactly 3 curves (more or less)
  - Automatically forms composites, splits.



1 curve



5 curves

- One tri-valent vertex.
- More flexible intervals than rectangles

Submap Surface Meshing

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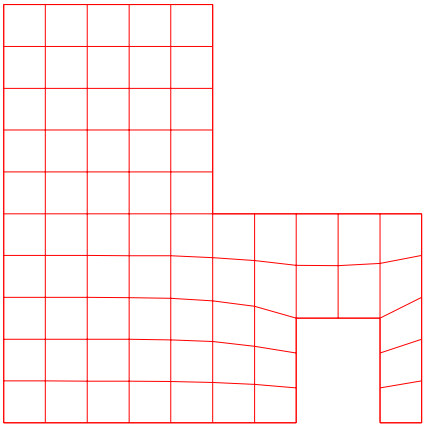
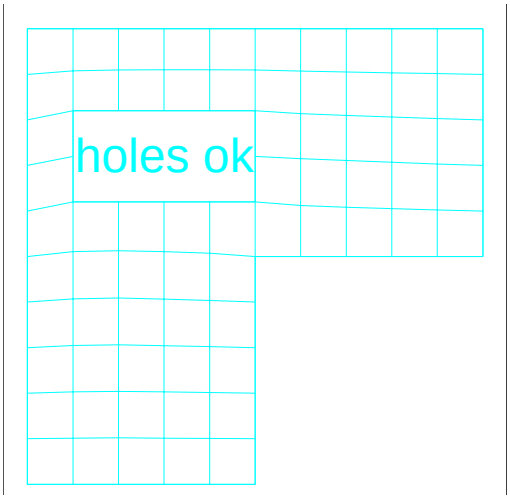
`Surface <id_range> Scheme` Submap

Structured Mesh for non-rectangular regions!

- Generalization of rectangle-primitive mapping.
- Virtual decomposition into mappable subregions.
- Works great for
  - rectalinear (cartesian) surfaces
  - equal size curve intervals





Demos: triangle.jou (does quality metrics) submap1.jou

HW: Experiment with different schemes, see which produces best mesh for a given geometry.

Which algorithm to use?

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Curves

- equal (usually)
- bias (small elements at one end)
- featuresize (if geometry dictates element size)

Surfaces

try `scheme auto`, change if problems

- map if (nearly) rectangle, no reflex angles
- submap if rectalinear (cartesian)
- triangle if (nearly) three-sided
- paving if general surface, or element sizes vary

Example files (compare schemes)

- surface-schemes-homework1.jou
- surface-schemes-homework2.jou

Advanced Surface Meshing Parameters & Troubleshooting

Check the mesh quality.

- `Quality entity <id>`
  - lists possible ‘metric_names’
- `Quality entity <id_range> Draw ‘metric_name’`

Poor quality mesh? Could be:

- not topology. (Mesh will be well-defined.)
- Scheme inappropriate for geometry?
  - E.g. mapping surface with reflex angles.
- Need to smooth?
  - Different schemes available. Use help.
- Poor interval settings, rapid transitions.

Advanced Surface Meshing Parameters & Troubleshooting

Curve meshing failure?

- Matching intervals: structured algorithms, hard-sets difficult.
  - try soft-setting more curves
  - try setting more surfaces to scheme pave
  - try manually setting corners

```
Surface <surface_id_range> Vertex <vertex_id>
        Type {side|end|corner|reversal|triangle}
```

Surface meshing failure?

- Matching intervals? Did you mesh surfaces one by one?
  - e.g. '`mesh surface all`'?
- Rapid change in intervals between adjacent curves?
- Interval size too large for geometry?
- Inappropriate surface scheme?